ON THE NATURALISED FORMS OF LAND AND FRESH-WATER MOLLUSCA IN AUSTRALIA.

By Chas. T. Musson, F.L.S.

Having been fortunate enough during the past year to get together examples of several imported slugs, it may prove of some interest to give a short account of the same, as well as of some shell-bearing forms that have also found their way to these southern climes.

Colonization of mollusca has been, along with the distribution of other organisms, constantly going on. We cannot claim for our molluscan friends, however, that they have themselves acted other than passively in the matter, except in cases where self-preservation may cause certain efforts to be put forth for a certain purpose; every instinct then asserts itself, no doubt, endeavouring to preserve *that* life, which is dear even to the crawling snail.

A long paper might be written upon those methods in nature, either detected or suspected, through which the land and fresh-water mollusca are or may be distributed.

In these few remarks I do not wish to call special attention to the diverse ways in which this might be effected, or the means by which we have received what are most popularly known as intolerable garden pests.

No doubt, in the case of most of the species now to be considered, the agency of man has, either designedly or involuntarily, been the means by which our imported snails came to take up their residence in Australasia.

Man has, in time past, for food purposes, and acting with forethought, in different countries exported and imported snails;

as in the case of *Helix pomatia*, L., the Apple snail (somewhat of the appearance of our *H. pachystyla*), which was taken to Britain by the Romans and reared in large numbers. Many thousand tons of so-called shell-fish are used per annum as food, in Europe alone, land forms amongst them.

A case amongst fresh-water shells may also be quoted, in this instance brought about involuntarily.

Planorbis dilatatus, Gould, an American form, was recorded about 1870 from canals at Manchester, believed to have been introduced with cotton.

Again, the accidental importation of *Dreissena polymorpha*, Pallas, the Zebra mussel, probably with timber from the Baltic, proved in a few years as great a pest in one way as the Canadian water weed did in another.

The forms now found, some of them in abundance, throughout Australasia are, with one exception, from Western Europe. They are as follows :—

Fresh Water Univalves :—*Limnæa peregra*, Müller ; *L. stagnalis*, Linné ; *Planorbis spirorbis*, Müller (?) ; *Neritina fluviatilis*, Linné.

Naked Mollusca or Slugs :—*Arion ater*, Linné ; *A. hortensis*, Fér. ; *A. fuscus*, Müller ; *Amalia gagates*, Drap. ; *Limax agrestis*, Linné ; *L. flavus*, Linné ; *L. maximus*, Linné.

Shell-bearing Mollusca or Snails :—*Zonites cellarius*, Müll. ; *Z. nitidus*, Müll. ; *Helix aspersa*, Müll. ; *H. nemoralis*, Linné ; *H. caperata*, Mont. ; *H. pulchella*, Müll. ; *H. virgata*, Da Costa (?) ; *Bulimus acutus*, Müll. ; together with *Helix similaris*, Fér., a widely diffused southern species not found in Europe.

These make up a most interesting list.

It should be noted that two of the species are very doubtfully Australian, viz., *P. spirorbis* and *H. virgata*. The fact that examples of these two species are in the British Museum labelled Australian is insufficient evidence. The former species is from the Cuming collection. The latter was only recorded after a lapse

of about thirty years from the original date of supposed collection. We cannot admit either species to a permanent position in our records without corroborative evidence.

Another species, a *Planorbis*, found near Melbourne, stated to be introduced, is, Mr. Brazier informs me, an indigenous *Segmentina*.

Another European species of slug is found with us, viz., *Limax lævis*, Müll., (syn. *L. Queenslandicus*, C. Hedley, P.R.S.Qld., 1888; *L. Rarotonganus*, Heyneman), an exceedingly glossy form about $\frac{3}{4}$ of an inch long. Recorded from Queensland, N.S.W., Victoria, and New Zealand; very widely distributed. We may, I think, consider this an indigenous form. It is found in very out of the way places, and far away from the coastal cities in such situations that we can but consider it as indigenous. Mr. Hedley is quite of this opinion, and I am disposed to agree with him.

Godwin-Austen describes a *Helicarion* under the specific name of *Helenæ* from Sydney; it is a synonym of *H. hyalinus*. Mr. Brazier states that the examples obtained by Godwin-Austen were from a colony introduced from Queensland.

We may note that Professor Hutton describes a *Testacella* (species *vagans*) from gardens in the vicinity of Auckland, N.Z, a carnivorous slug-like mollusc carrying a small ear-shaped shell on its tail. Representatives of this genus usually live in gardens, under the surface of the ground. There are three distinct British forms. Mr. Cheeseman of the Auckland Museum thinks their species may prove to be one of the European forms, possibly *T. mangei*, Fér.

A species of slug has been described by Gould (Otia Conch.) from Parramatta, as *Limax olivaceus*. The length is given as $\frac{2}{5}$ inch; Tryon, however, (Man. Conch. Vol. I.) gives 2·5 inches as the size, and figures (pl. 50, f. 81) a slug corresponding with the size given. If the latter be correct it is probably a form of *L. flavus*, L.; whilst if Gould's measurement be correct, it is probably *L. lævis*. The latter form, it may be noted, is found in the original locality. Tate (in P.R.S. Tasmania, 1880) has also

described three species of S. Australian and Tasmanian slugs. It would be interesting to see examples of all these forms, as one cannot but feel somewhat suspicious as to their claim to be indigenous. They may prove to be merely introduced. Another species, *Milax antipodum*, has been described from New Zealand by Pfeiffer; whilst Gould has described *Limax fuliginosus* from the same colony. Tate suggests that these two may prove to be specifically identical; they might also be European. Hutton also describes from New Zealand *Milax emarginatus*, (Trans. N.Z. Inst. XI., p. 331).

Another slug, unknown to us here, has been described by Selenka, *Limax pectinatus* (in Malak. Blatt. XII. p. 105, pl. 2, figs. 1-9); it is probably *A. gagates*. It is a pity when Australian forms happen to be described abroad, that typical examples are not forwarded to the country from whence they came.

Quoy and Gaimard described (Zoology of Freycinet's Voyage in the Uranie, 1824, pp. 426, 427) two slugs from Port Jackson under the names of *Limax megalodontes* and *L. maurus*. From the very meagre descriptions, and absence of figures, it is impossible to say exactly what these are; possibly they may have been introduced forms the former perhaps *Limax flavus*, and the latter *Amalia gagates*.

It is interesting to note that the tide, so far as evidence from a consideration of our molluscan connections with Europe goes, is one of emigration from North to South, of hardy temperate forms to warmer regions, following out an old established rule.

Legrand says (P.R.S. Tas. 1870), that *Helix Morti*, Cox, which is found near Hobart, has probably been introduced from N.S.W., in mould with plants. Cox also records *H. cyclostomata*, Le Guill., as received from Melbourne; it is a native of Queensland.

It is a curious fact, that some of the British species included in the above list are not by any means the commonest forms in that country; whilst some of the commoner forms *there* have not as yet reached *us*; amongst them it may be observed, that *Helix hispida* and *H. rufescens*, as yet unknown here, have made themselves at home in the United States.

It can be said, also, that those species possessing special facilities for distribution; namely, in being on the whole plentiful, and inhabiting such situations (cellars, gardens, proximity to sea, grass fields, &c.), as would put them in the way of having chances of emigration forced upon them, have been the fortunate ones, if we may so term it.

Certain other fresh-water forms one might also expect to see that do not exist here. It would not be surprising to find that European forms of *Ancylus*, *Pisidium*, *Sphærium*, or *Planorbis* are identical with some of our so-called indigenous forms; or may find their way here in time.

Doubtless some forms are better fitted by constitution or otherwise for emigration, and the better able to adapt themselves to circumstances, temperate forms being particularly favoured in this respect.

We should particularly notice the fact that our N.S.W. form of *H. aspersa*, so far as my observation goes (and Mr. Hedley confirms it), is smaller and thinner than the type, and may be considered the variety *tenuior*, whilst var. *conoidea* is often seen in New Zealand. The former small, very thin, transparent, reddish, often without bands; the latter thin, small, and conical. It is a very variable shell. The exceptional thinness of our form might be set down to want of lime in the soil, scarcity of, or difference in, food. This does not, however, necessarily always appear to be the case: on sandy soils on New Red Sandstone in the Midland Counties of England this species attains normal size and thickness. Mr. Carson informs us that shells found in the Melbourne botanical gardens are much larger and thicker than our Sydney form. Of course the curious point is whether the variety *tenuior* has been introduced here, or whether it has arisen by reason of changed circumstances, from the introduced typical form.

May it not be probable that the change to our warm and equitable climate is one cause, enabling the animal to do with a thinner protective shell than in colder England? (In S. Europe there is an attenuated form, *H. aperta*, allied to its larger congener.)

Whilst the absence of their natural enemies in the shape of Blackbirds, Thrushes, and such like may be another cause helping to produce the effect above-mentioned, inasmuch as the absence of hereditary enemies might in time deaden somewhat those instincts in the animal which cause it to be on the alert for danger. In other words—Given no present necessity for a thick shell as a protection against enemies or cold, together with constant changed environment and altered circumstances (food, climate, times, and seasons, &c.), differing altogether from the ancestral experiences (I mean the relations of the ancestral type form to its environment), we can, I think, quite conceive that there may be sufficient causes operating to bring about such an effect as we see in the thin shells of *H. aspersa*, even after only a few short generations.

Binney in his "Land Shells of the United States," points out that *Helix hortensis*, a common European banded snail (only recorded with us from N.Z.), has been transplanted to some of the small islands on the east coast of the United States in the vicinity of Cape Ann, occurring there in countless numbers. It is worthy of notice that each island is inhabited by a variety peculiar to itself, showing that the variety which happened to be introduced there has propagated itself without a tendency to run into other varieties.

It will be noticed that we have as yet very few records of the imported species, absolutely none for some of the colonies. It would be worth while for those interested in the subject to help in extending our knowledge by collecting and preserving examples of these neglected forms for the purpose of identification and the completion of a comprehensive series of records. The best plan for preservation is to drown the animal in water before placing in spirits.

Good figures of the Slugs may be found in Zeitschrift für wissenschaftliche Zoologie, 1885, plate VII., with an article on the European species by Dr. Simroth, whilst full lists of synonyms may be obtained from Lovell Reeve's "British Mollusks" and other works.

My thanks are due to Messrs. Brazier and Hedley for information on this subject, freely and kindly given. It is to hoped that these few remarks, together with a list of Australasian records (so far as known) appended below, will cause a little more attention to be paid to our introduced forms of Mollusca, which, although often found to be arrant pests, are like ourselves, making a new home in a country to which their forefathers were strangers.

List of the Naturalised Land and Fresh-water Mollusca found in Australasia.

LIMNÆA PEREGRA, Müller, 1773.

L. Hobartensis, T.-Woods, P.R.S. Tas. 1875.

An abundant species, ranging throughout Europe, to Siberia, Thibet and Afghanistan. Inhabits sluggish streams, ponds and ditches; as a rule not so large in fast-running water, but cleaner and more elegant. A great wanderer.

Tasmania: neighbourhood of Hobart (T.-Woods and W. F. Petterd).

LIMNÆA STAGNALIS, Linné, 1758.

L. Tasmanica, T.-Woods, P.R.S. Tas. 1875.

Common in Europe; also found in Siberia and Cashmere.

Inhabits stagnant water usually.

Frequently found floating shell downwards on the surface of water; a favourite habit also of *L. peregra*, and species of the Bulinus family.

New Zealand; Auckland, at the Onehunga Springs; Christchurch, in the River Avon, said to have been introduced intentionally as food for trout.

Tasmania: Hobart (T.-Woods).

Examples of this form in the Melbourne Museum appear to belong to the variety *fragilis*.

PLANORBIS SPIRORBIS, Müller, 1774.

In stagnant water and sluggish streams in every part of Gt. Britain.

Mr. E. A. Smith in his list of Aus. F.-W. Shells (Journ. Linn. Soc. Zool. 1881) states there are two tablets of this species in the British Museum, originally from the Cuming collection, and labelled North Australia.

As this species has not been seen in any of the colonies, so far as I am aware, we can hardly properly include it in the Australian fauna without some confirmatory evidence.

NERITINA FLUVIATILIS, Linné, 1758.

Ranging from Finmark to Sicily; found on stones and walls in canals and rivers.

New Zealand: reported from the Waikare river (Kirk).

ARION ATER, Linné, 1758.

Very variable; commonly called the black slug. Black, chocolate, red, yellow or greenish, sometimes whitish, coarsely tubercled, foot usually yellowish; shell consisting of granules only, internal; back not keeled. From 3 to 5 inches long.

Ranging from Siberia to Corsica. Introduced into United States. Commonly found in woods, fields and gardens in moist places; about wells and pumps.

New Zealand: Dunedin (Hutton); Auckland, crawling over the roads after rain (Musson).

ARION FUSCUS, Müller, 1774.

Arion incommodus, Hutton, Trans. N.Z. Inst., XI., p. 331.

An inhabitant of N.W. Europe.

New Zealand: Dunedin (Hutton).

ARION HORTENSIS, Müller, 1774.

A small slug, varying in colour from black to brown, rufous, yellowish, grey, or greenish, usually striped longitudinally, tubercled, foot lighter than back, not keeled, shell internal, and consisting of granules only. About $1\frac{1}{2}$ inches long.

Of European origin, ranging from Siberia to Corsica. It has made its way to North America. Found in fields and damp places, under logs and stones.

New Zealand : Auckland, plentiful ; crawling about the roads after rain (Musson).

This species, with *Arion ater*, appears to affect cool climates ; they have not yet been heard of as inhabiting Australia.

Amalia gagates, Drap., 1801.

A very variable slug : black, slate colour, dark red, brown or yellowish, with dusky markings, pale underneath, acutely keeled from mantle to tail, shell internal. A small calcareous plate. From $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long.

Common in S. Europe, scarce in England ; inhabits hedgerows and gardens amongst vegetable matter. Also found in many parts of the world.

New Zealand : Ohaupo and Auckland (Musson).

New South Wales : Tamworth (Musson) ; Sydney, under stones at Darling Point, in company with *L. agrestis* (G. Neville) ; Gladesville (H. Deane) ; abundant near Sydney (Brazier).

Victoria : Ballarat, under garden rubbish, stones and wood, also on cabbages, coming out at night and in the early morning (Musson).

Limax agrestis, Linné, 1758.

L. molestus, Hutton, Trans. N.Z. Inst., XI. p. 331.

A common slug, usually ash-grey, rufous, yellowish, cream colour or whitish, often mottled ; with a short keel at the tail ; shell internal, consisting of a calcareous plate such as all the Limaces have. From $1\frac{1}{2}$ to 2 inches long.

Found in gardens, fields, hedgerows, under stones and wood, throughout Europe. Also in the maritime cities of the United States. Very destructive to garden produce ; sometimes called the cabbage or white slug, and eaten as a cure for diseases of the chest.

New Zealand : Auckland, Wellington, Nelson, Greymouth, Christchurch, Dunedin, &c. (Hutton).

N.S.W. : Under stones at Darling Point (G. Neville) ; Tamworth (Musson).

Victoria : Melbourne (Kershaw).

Limax maximus, Linné, 1758.

A large slug; colour varying from ash to yellowish-grey or sometimes black; often streaked or spotted with white or black; much wrinkled. From 4 to 6 inches long.

Abundant in Europe from Finland to Corsica, Madeira and Syria. Introduced into North America. Found in damp retired and shady situations.

New Zealand: Dunedin (Hutton).

N.S.W.: common in and around Sydney (Brazier).

Victoria: Ballarat, under logs in the bush five miles from city (Musson).

Tasmania: gardens and cellars at Hobart (Tate), and Launceston (Hedley).

Mr. Brazier showed me an example of this species found at Summerhill near Sydney, by Mr. R. J. Etheridge: pale grey with black spots, evidently the European var. *maculata*. It approaches somewhat *L. psarus*, Bourg., from Lombardy, as figured in Tryon's Manual, (pl. 46, fig. 37), but the spots have no tendency to run into lines.

Mr. Hedley informs me that examples of *L. maximus*, obtained in Mr. Petterd's garden at Launceston, are infested with an *Acarus;* possibly the same as found under similar circumstances in England. (*L. flavus* also suffers in the same way.) An interesting fact. The question is, did the host when fully grown bring out its parasite from original home, or has the slug, since coming out of the egg here, contracted the habit of giving house room to its uncongenial neighbour. An investigation of this question might throw some light on the manner in which our imported slugs (and their ally) have found their way here.

Limax flavus, Linné, 1758.

Limax variegatus, Drap.; *Limax Breckworthianus*, Heynemann, recorded from Sydney, Malak. Blatt. XIV. pp. 131-133; *L. bicolor*, Selenka, Ibid., XII. pp. 105, 173, XVI. 50.

A yellowish slug, tessellated with white and black, or dark brown, coarsely tuberculated, very variable as are all these

creatures; keeled towards the tail, which is pointed. From $2\frac{1}{2}$ to 4 inches long.

Affects cellars and damp places in houses, moist woody places, under stones, &c. Active and voracious, frequently finding its way to cream in dairies.

European originally, it ranges from Siberia to Corsica; found in Madeira, and the Eastern Cities of the United States, having been introduced to the latter locality.

New Zealand: Dunedin and Greymouth (Hutton).

Queensland: Hedley saw what he believed to be an example of this species in Brisbane.

N.S.W.: Gladesville and Summer Hill (Brazier); Inverell (Duncan); Tamworth, on walls of a well (Musson).

Victoria: Benalla (Brazier).

Tasmania: Launceston (Hedley).

A specimen of this species came regularly to a flour bag in which there happened to be a rent. It was only on my going to the bag one night I found the slug gorging itself on the flour, although its slime track had been observed fresh at intervals for upwards of a fortnight.

Zonites cellarius, Müller, 1774.

Helix Sydneyensis, Cox, Mon. Australian Land Shells, species 19, p. 9.

A widely distributed species. Originally European, it has found its way to the United States, Madeira, Canaries, Cape Town and Palestine.

Often found in cellars, it also affects damp places under stones, logs, &c., in vicinity of towns.

New Zealand: Bay of Islands, Napier (Hutton); Auckland, under stones, especially about the various volcanic mounts (Musson).

N.S.W.: Sydney, abundant in gardens and cellars (Brazier).

Victoria: Melbourne (Kershaw).

Tasmania: Launceston (Petterd).

ZONITES NITIDUS, Müller, 1774.

Helix nitida, Cox, Mon. Aus. Land Shells, species 20, p. 9.

A native of Europe, ranging from N. Russia to Algeria, and as far as Thibet in Asia; it has found its way to North America, Japan and elsewhere. Found in damp places.

New Zealand: Lake St. John, Auckland, a dozen specimens, under logs (Musson).

N.S.W.: Darling Point, Lyndhurst and elsewhere, about Sydney (Cox); often found in hot houses (Brazier).

HELIX ASPERSA, Müller, 1774.

European in its origin, it is now very widely diffused through St. Helena, Mauritius, Cape of Good Hope, Brazil, United States, and New Caledonia.

A voracious animal, which has even been known to perforate birds' eggs for food. It inhabits gardens, old walls, &c.

New Zealand: common at most of the sea coast towns. Examples from Apua in the Bay of Islands are exceptionally thin, whilst shells from Auckland are of the variety *conoidea* (thin, small, and conical).

N.S.W.: Dubbo and Coonamble (Brazier); Sydney, very common in gardens, as at Elizabeth Bay and Double Bay. Dr. Cox found a very interesting monstrosity of this form in the shape of a well marked turriculated specimen in his garden at the North Shore, Sydney.

The species is often seen sheltering in large quantities inside the cut hollow stems of bamboo; an interesting fact, if we remember that the most ancient of all known fossil land shells, from carboniferous beds in the United States, have been found inside calamite stems.

Our N.S.W. forms of this shell belong chiefly to the variety *tenuior* (smaller, very thin and transparent).

Tasmania: common, near towns on coast.

Victoria: common, in and near Melbourne.

Nowhere do we find the large, thick shells so often seen in England.

It does not seem to occur at Brisbane. Neither Mr. Brazier nor Mr. Hedley has ever seen it in Queensland, nor have I ever observed it there. A curious fact.

HELIX NEMORALIS, Linné, 1758.

A fine yellow-banded shell, very variable; widely diffused throughout Europe. Introduced into United States.

New Zealand: Auckland (Hutton), our only record.

HELIX VIRGATA, Da Costa.

Generally confined to the sea coast. N. France, Italy, Greece, and N. Africa.

Mr. E. A. Smith in his report on "Mollusca of Voyage of the Erebus and Terror," 1843 and 1844, published in 1874, says, "Two specimens of this species are marked as coming from Foul Point, N.W. Coast of Australia (Richardson)," and adds that Mr. Gwynn Jeffreys records a sinistral variety as coming from N.S.W.

Nothing more is known about this species as inhabiting Australia.

It is figured in the volume quoted. Its belonging to the Australian fauna must be considered doubtful.

HELIX CAPERATA, Mont., 1803.

Widely diffused over the greater part of central and southern Europe, both inland and maritime; not common in the north.

Victoria: Melbourne, the typical form common in gardens for ten years past (Kershaw).

Tasmania: (Petterd *teste* Hedley).

HELIX PULCHELLA, Müller, 1774.

Helix Alexandræ, Cox, Mon. Aus. Land Shells, species 154, p. 61.

Common in Europe and North America; indigenous to both; found also in Thibet. Introduced into Madeira, Azores, Cape Town, Palestine, &c.

N.S.W.: Eastern Creek, in flood refuse (Brazier); Sydney, Petersham, Marrickville, Darling Point, Glebe, and other places.

Tasmania: Hobart, in gardens.

Norfolk Island: in the old gaol yard, 1865 (Brazier).

Bulimus acutus, Müller, 1774.

Confined to the seaboard of Central and Southern Europe.

Mr. Petterd records in Journ. Conchology that during 1879 some examples of this species were forwarded to him. Dr. Cox also had some specimens about same time. Mr. Kershaw recently gave me examples (typical form) found by him in a Fitzroy garden, Melbourne. Probably the original locality for specimens received by Petterd and Cox.

Helix similaris, Férussac.

A species of remarkably wide range, found in Cuba, N.W. America, Natal, Formosa, Mauritius, Hongkong, Sandwich Islands, Buenos Ayres, Brazil, Singapore, Bengal, Java.

Originally recorded for Australia from the Frankland Islands, collected by MacGillivray. Mr. Brazier, who had some of the original specimens, remarks that they were *H. aridorum*, Cox, and not *similaris*. The only locality known in Australia for *H. similaris*, Fér., is Sydney, where it is found in plenty after rain in gardens at Elizabeth Bay and at Guilfoyle's Nursery, Double Bay; no doubt brought with plants from Mauritius.

Cox remarks this shell is much like *H. marcescens*, Cox, found by MacGillivray at the Clarence River.

An interesting species which forms a thin, dry, and papery epiphragm.

Mr. Brazier tells us that amongst a large number of *H. similaris* from a Glenmore-road garden he found a reversed specimen.

Postscript.—Since the above was in type I have received from Mr. Hedley the following note:—"Specimens of the slugs *Limax Legrandi*, Tate, and *Milax Tasmanicus*, Tate, described in the P.R.S. Tas. 1880, p. 16, were collected by me during a recent visit to Tasmania. The first appears to be the European *L. agrestis*, and the second, as anticipated by the author, to be *L. gagates*, also introduced." 21st Feb., 1891.